FOR EDEXCEL

GCE Examinations

Advanced Subsidiary

Core Mathematics C2

Paper J

MARKING GUIDE

This guide is intended to be as helpful as possible to teachers by providing concise solutions and indicating how marks could be awarded. There are obviously alternative methods that would also gain full marks.

Method marks (M) are awarded for knowing and using a method.

Accuracy marks (A) can only be awarded when a correct method has been used.

(B) marks are independent of method marks.

Written by Shaun Armstrong

C2 Paper J – Marking Guide

1. *(a)* 11 a.m. $\therefore t = 3$

$N = 20\,000 \times (1.06)^3 = 23820$ (nearest unit) — M1 A1

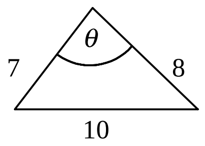
(b) $40\,000 = 20\,000 \times (1.06)^t$

$(1.06)^t = 2$ — M1

$t = \frac{\lg 2}{\lg 1.06} = 11.8957$ — M1 A1

11.8957 hours = 11 hours 54 mins $\therefore$ 7.54 p.m. — A1 **(6)**

2.



$10^2 = 7^2 + 8^2 - (2 \times 7 \times 8 \times \cos\theta)$ — M1 A1

$\cos\theta = \frac{49+64-100}{112} = \frac{13}{112}$

$\theta = 83.335$ — M1 A1

area $= \frac{1}{2} \times 7 \times 8 \times \sin 83.335$ — M1

$= 27.8\text{ cm}^2$ (3sf) — A1 **(6)**

---

3. *(a)*

x	0	0.25	0.5	0.75	1	M1
$\frac{4x}{(x+1)^2}$	0	0.64	0.8889	0.9796	1	A1

area $\approx \frac{1}{2} \times 0.25 \times [0 + 1 + 2(0.64 + 0.8889 + 0.9796)]$ — B1 M1

$= 0.752$ (3sf) — A1

(b) under-estimate — B1

the curve passes above the top edge of each trapezium — B1 **(7)**

---

4. *(a)* $(x + \frac{k}{x^2})^{15} = x^{15} + 15(x^{14})(\frac{k}{x^2}) + \binom{15}{2}(x^{13})(\frac{k}{x^2})^2 + \ldots$ — M1 A1

$\therefore\ 15k = 30$ — M1

$k = 2$ — A1

$A = \frac{15\times14}{2} \times k^2 = 420$ — A1

(b) $(x + \frac{2}{x^2})^{15} = \ldots + \binom{15}{5}(x^{10})(\frac{2}{x^2})^5 + \ldots$ — M1 A1

term indep. of $x = \frac{15\times14\times13\times12\times11}{5\times4\times3\times2} \times 32 = 96\,096$ — A1 **(8)**

---

5. *(a)* $4x^{\frac{1}{3}} - x = 0$

$x^{\frac{1}{3}}(4 - x^{\frac{2}{3}}) = 0$ — M1

$x^{\frac{1}{3}} = 0$ (at O) or $x^{\frac{2}{3}} = 4$ — M1

$x \geq 0\ \therefore x = (\sqrt{4})^3 = 8,\ a = 8$ — A1

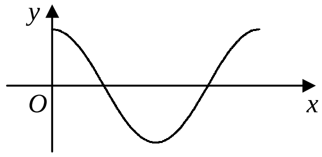
(b) $= \int_0^8 (4x^{\frac{1}{3}} - x)\ dx$

$= [3x^{\frac{4}{3}} - \frac{1}{2}x^2]_0^8$ — M1 A2

$= (48 - 32) - (0) = 16$ — M1 A1 **(8)**

---

6. *(a)*



B2

(b) $(0, 1), (\frac{\pi}{4}, 0), (\frac{3\pi}{4}, 0)$ — B3

(c) $\cos 2x = 0.5$

$2x = \frac{\pi}{3}, 2\pi - \frac{\pi}{3}$ — B1 M1

$2x = \frac{\pi}{3}, \frac{5\pi}{3}$

$x = \frac{\pi}{6}, \frac{5\pi}{6}$ — M1 A1 **(9)**

---

7. *(a)* $= (\frac{-2+4}{2}, \frac{6-1}{2}) = (1, \frac{5}{2})$ — M1 A1

(b) radius = dist. $(-2, 6)$ to $(1, \frac{5}{2}) = \sqrt{9+\frac{49}{4}} = \sqrt{\frac{85}{4}}$ — M1 A1

$\therefore\ (x-1)^2 + (y - \frac{5}{2})^2 = (\sqrt{\frac{85}{4}})^2$ — M1 A1

$x^2 - 2x + 1 + y^2 - 5y + \frac{25}{4} = \frac{85}{4}$

$x^2 + y^2 - 2x - 5y - 14 = 0$ — A1

(c) $(2, 7)$, LHS $= 4 + 49 - 4 - 35 - 14 = 0$ $\therefore$ R lies on circle — B1

$\angle PRQ = 90°$ — B1 **(9)**

---

8. *(a)* $r = \frac{\log_3 16}{\log_3 4} = \frac{\log_3 4^2}{\log_3 4} = \frac{2\log_3 4}{\log_3 4} = 2$ — M2 A1

(b) $ar = \log_3 4$

$a = \frac{\log_3 4}{2} = \frac{\log_3 2^2}{2} = \frac{2\log_3 2}{2} = \log_3 2$ — M1 A1

(c) $S_6 = \frac{(2^6 - 1)\log_3 2}{2-1} = 63 \log_3 2$ — M1 A1

$= 63 \times \frac{\lg 2}{\lg 3} = 39.7$ — M1 A1 **(9)**

---

9. *(a)* $f(3) = 27 - 36 - 9 + 18 = 0$ $\therefore$ $(x-3)$ is a factor — M1 A1

(b)

$$
\begin{array}{r|rrrr}
 & x^2 & -\ x & -\ 6 & \\
\hline
x-3 & x^3 & -\ 4x^2 & -\ 3x & +\ 18 \\
 & x^3 & -\ 3x^2 & & \\
\hline
 & & -\ x^2 & -\ 3x & \\
 & & -\ x^2 & +\ 3x & \\
\hline
 & & & -\ 6x & +\ 18 \\
 & & & -\ 6x & +\ 18 \\
\hline
\end{array}
$$

M1 A1

$f(x) = (x-3)(x^2 - x - 6)$

$f(x) = (x-3)(x+2)(x-3) = (x+2)(x-3)^2$ — M1 A1

(c) $(3, 0)$ — B1

$(x-3)$ is a repeated factor of $f(x)$ $\therefore$ x-axis is tangent where $x = 3$ — B1

(d) $f'(x) = 3x^2 - 8x - 3$ — M1 A1

for SP, $3x^2 - 8x - 3 = 0$ — M1

$(3x+1)(x-3) = 0$ — M1

$x = -\frac{1}{3}, 3$ $\therefore$ $x = -\frac{1}{3}$ — A1 **(13)**

Total **(75)**

Performance Record – C2 Paper J

Question no.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	Total
Topic(s)	logs	cosine rule	trapezium rule	binomial	area by integr.	trig. graph	circle	GP, logs	factor theorem, SP	
Marks	6	6	7	8	8	9	9	9	13	75
Student										